### Task 3 Reporting

Review of
Draft – Technical Documentation to Support Development of Minimum Flows and
Levels for the Loxahatchee River and Estuary

South Florida Water Management District Water Supply Division July 15, 2002 Draft

Task 3 Planning & Development Division Request for Expert Assistance requests comment on the current MFL document, addressing General Questions and Specific Technical Issues in the RFA as a basis for that review. This review follows a set of comments made in June 2001. That review included a response to general questions and specific technical issues, similar to this review, and the submission of an overall panel review report.

My review of the revised report will be completed in two parts. The first part provides a general review, directed to the overall document "package" with an emphasis on technical issues and water resource functions. The second part will use the June 2001 comments as a starting point to address how those reviews have been incorporated into the 2002 technical documentation.

### Part #1 - General Review

My general review of the 2002 documentation is that this report makes a sound scientific case for the establishment of minimum flows and levels, and presents strong justification for establishing a Loxahatchee River MFL. I find that the report adequately addresses legal and policy factors, relevant water resources functions, considerations and exclusions, and a level of protection based on the MFL standard of significant harm. The report also provides a recovery and prevention strategy, which incorporates adaptive management elements to address uncertainty.

A general comment made about he 2001 draft report was that the organization and presentation could be improved with different placement of text, improvement of illustrations, and careful editing. For the most part, I find that the 2002 Draft has addressed these issues. The present report organization is understandable, although still redundant, and the use of illustrations and data tables is much improved.

I do have a major criticism addressing discussions in multiple sections. This criticism finds that after typically lengthy discussion, where efforts have been made to fully support an argument, that after the conclusions an additional concluding statement is made that qualifies the conclusions. The qualification is often based on data limitations,

a lack of full scientific understanding, or other uncertainty, which is common in this type of analysis. There is no doubt that limitations to findings should be clearly identified, but the present approach tends to diminish support for a finding, rather than qualify a finding in relation to expected, and acceptable uncertainty. I would suggest additional editing in Chapter 4 and 5 to address this issue. I found that the detailed technical support in the appendices adequately addresses uncertainty in the various analyses. In the first volume of the technical documentation I would suggest that issues of uncertainty be addressed early in the summary discussion so that the conclusions reached can stand alone. I would also suggest that the editor choose some method of highlighting critical conclusions, such as italics, so that the reader will be better able to connect specific technical findings in each section with the final arguments supporting MFL establishment.

In summary, I found the 2002 draft documentation to be highly responsive to reviewers concerns. In addition to editing and organization, it is clear that the District staff have completed additional supporting assessment and analysis, significantly strengthening the justification for, and the establishment of, minimum flows and levels for the Loxahatchee River and Estuary.

## Part #2 - General Questions and Specific Technical Issues

The Request for Expert Assistance identified four general questions, three questions similar to those asked of the 2001 Draft, and a fourth question related to responsiveness to reviews. Because the comments made in 2002 can provide a basis for evaluation of the 2002 draft, and addressing question #4, I have chosen to include my comments from last year, and use those comments as a basis for the review of the 2002 draft.

1. Does the MFL Document present a defensible scientific basis for setting initial minimum flows criteria for the water body?

The document presents a good argument, but it fails to provide a fully "scientific" basis for the argument in some circumstances. The major criticism from this reviewer is that a number of unproven assumptions, based on observations or common sense have been introduced as accepted fact with little support, other than the ideas are repeated in the document. For example, the 2 ppt salinity threshold is identified early in the document with little support for its selection (although arguments supporting 2 ppt are made late in the document the general scientific support for this number is weak). Further, the entire document hinges on a proposed relationship between salinity and the selected VEC. Based on the assumption that salinity is the controlling factor of the Cyprus community, the entire document constructs an argument. Unfortunately this argument is often challenged by specific statements in the document. The "scientific" sense of this reviewer is that the foundation for the arguments is sound, but the report in its present organization fails to scientifically substantiate statements based on specific citation of reference documents or more general reference resources from

engineering, ecology, or limnology/oceanography. I do not see this as a fatal flaw of the report, but a problem that must be addressed to provide the most defensible recommendations on MFLs.

### 2002 Review

I find that the 2002 draft presents a defensible scientific basis for setting the initial minimum flows criteria. Where the 2002 document often relied on unproven assumptions, the 2002 draft more adequately develops technical arguments, adds critical data on vegetation and soils, and makes better use of model capabilities.

In summary, the revised organization of the report, the addition of additional assessment and analysis data, and the reformulation of how arguments for MFL establishment are integrated finds good technical support for the proposed MFL. In addition, the report specifically identifies the need for adaptive management, and provides a sound assessment and research plan to support future improvement of an established MFL.

The appropriate use of technical support, and the inclusion of adaptive management now takes advantage of the most effective water resources management tools.

1b. Are the approaches or concepts described in the document scientifically sound based on 'best available information'?

In terms of the internal definition of 'best available information' generally used in this document, the approaches and concepts are generally sound. This said, the literature support for this report is somewhat limited, and could be expanded to include reference to fundamental physical principles associated with flow and mixing, and basic ecological theory. The report could benefit from a better description of flow input to the watershed (particularly things like groundwater/base flow enhancements associated with wetland restoration), and salt wedge dynamics, particularly as those dynamics are associated with freshwater inflow volumes. Similarly, the concept of VEC could benefit from a better sense of how communities are organized and the requirements for long term stability of ecosystem characteristics in a naturally changing environment. To provide an approach, the authors should consider selected use of sidebars, which will both provide better scientific support, and improve general readability for audiences with variable technical backgrounds.

### 2002 Review

Although the range of topics covered in this report could result in a bibliography that is as long as the report text, I find that this report strikes a reasonable balance between full literature documentation and the criticisms made last year. I find that the first volume cites important literature, demonstrating a good sense of background materials. The methods of integration of critical literature resources have been improved, leading to strengthening the technical arguments made in the report. This report has also improved

the VEC concept, replacing the dependence on bald Cyprus with the selection of community indicators, again, improving technical support for the arguments made.

2a. Are the proposed technical criteria logically supported by 'best available information' presented in the main body of the document?

Although the response to this question parallels the response to question 1a and b, the document may be over dependent on appendices, failing to present sufficient detail in the main body of the document.

### 2002 Review

This draft has found a good balance between the technical detail of the appendices and an adequate support for arguments in a summary technical document. I find that the inclusion of detail in the 2002 draft is sufficient to support the arguments made.

2b. What additions, deletions or changes are recommended by the Expert to enhance the validity of the document?

Response to this question is, in part, covered in comments to technical issues. In addition, it is expected that many of this expert's detailed comments will be addressed during meetings with staff. It will be at that time that comments from all reviewers will be discussed and integrated into a follow-on plan for document completion.

## 2002 Review

The present document is technically sound as presented. My only recommendation for change would be to consider preparation of an executive summary that would be accessible to a wider audience. This summary could briefly establish legal and policy factors and then summarize critical findings in support of the MFL. I can say that I had to wade through lengthly discussions, often with some foreknowledge of where the arguments were headed before a conclusion was reached. For a general audience, the technical analysis process can be simplified, still identifying critical steps, to reach the conclusions made. I think that a more accessible document will improve the support the District seeks from the range of stakeholders who have an interest in this MFL.

3a. Are their other approaches to setting the criteria that should be considered?

There are numerous other approaches to setting MFL criteria. Each of these approaches will have a different VEC base and require additional, and even alternate, justifications. That said, there is a critical issue in setting the MFL that has been ignored. In this water resources framework, we might expect the ecological components of the system to respond to concentration, duration, and frequency. In the MFL discussions the issues of concentration and duration have been addressed, but frequency is not included in MFL criteria. Let me suggest

that a 20 day flow subceedence, followed by a one day exceedence of the criterion flow, followed by another 20 day subceedence will meet MFL criteria, yet create a high potential for ecological damage because of the frequency of reoccurrence.

As soon as the MFL analysis moves into frequency, then the entire "package" must be improved to address seasonal, and other issues. The District might consider this issue very carefully, because it is in the time-scale arena that critical flows can be expected to make a difference. For example, there may be a critical period when Cyprus seedlings must have fresh water. Simply setting a MFL and a duration does little to meet that specific need, and the degradation of the community identified in this report may continue. Adding frequency will significantly alter the report, but consideration of this issue should be a major point of our upcoming discussions.

### 2002 Review

I was particularly pleased with the recognition of concentration, duration, and frequency as factors affecting the Loxahatchee ecosystem. I feel that District staff have done an excellent job developing the technical documentation that addresses these combined issues of salinity control. I feel that staff has effectively used the modeling tools at their disposal, and collected important additional data that assists in duration and frequency analysis. It is in the application of adaptive strategies based on additional data on duration and frequency that will improve the potential for MFL success. I think the staff has effectively captured issues of variability in this draft.

3b. Is their available information that has not been considered by the authors? If so, please identify specific alternatives to setting the MFLs and the data available to validate the alternative approach.

As mentioned previously, the literature support for this report is generally limited to local studies supporting focused arguments. There are a number of alternate methods for setting MFLs, found in the extensive literature associated with Instream Flow Needs (IFN). The U. S. Fish and Wildlife Service, and now National Biological Survey lead in addressing IFN issues. Alternative approaches, as noted above, will start with the definition of the VEC/target or indicator organism. There are alternatives that consider broader community response models. Rather than respond to this question with specific identification of alternatives, This reviewer suggests that the focus of discussion at our upcoming meeting should be on watershed integration with a systems view to set a MFL that is protective of a range of resources in keeping with the spirit of the Florida regulations. This comment is not intended to suggest an alternative approach, rather it is intended to strengthen the arguments in this report and adequately address a community "vision" appropriate to this watershed.

### 2002 Review

I find that the District staff has followed up on IFN approaches, and they have developed a community indicator model for analysis that further strengthens a community "vision" appropriate to this watershed.

4. Does the current draft MFL document adequately address the comments provided by the 2001 Peer Review Panel Final Report.

I believe the report has adequately addressed both the details, and the spirit of the 2001 peer review.

#### **Technical Issues**

The Statement of Work asked the reviewer to address the appropriateness of ten items (nine items nine common to the 2001 review, item #6 new this year. There is some overlap between these questions and my response to general questions, and there is overlap between technical issues.

1. Use of "Valued Ecosystem Component" approach for establishing the MFL.

The VEC is a reasonable approach for establishing a MFL but the support for selection of the specific VEC in this report is weak. For example, the arguments could be strengthened by relating Bald Cyprus to specific ecological community components that could be understood by a wider audience. Comments have already been made about the selection of a single parameter, such as salinity, as the primary control of community characteristics. The VEC discussions should be strengthened. Specific comments will be made in the detailed review.

### 2002 Review

The 2002 Draft has made significant alterations to the support of the VEC. The report recognizes the limitations of the use of Bald Cyprus as an indicator, and has developed a new indicator based on 6 VEC species. The change to a community indicator, supported by new analysis of vegetation now provides a good foundation for VEC determination. The VEC indicators have also been used appropriately, in conjunction with hydrologic analyses, to provide a sound argument for MFL determination. I feel that the VEC discussions have been sufficiently strengthened to support the MFL.

2. The proposed minimum freshwater flow regime proposed during drought.

Although there is good technical support for the proposed MFL, and the arguments focusing on mile 8 are persuasive to this reviewer, the number still seems to be drawn from a random lot, then supported by modeling that is

admittedly inadequate and a historical analysis that is very short term (only 6 years) that does not include a drought period. This reviewer also found the inclusion of multiple flow requirements at different locations in the estuary were confusing. Further, the estimates of tributary influence are particularly weak, and should be improved.

This reviewer is fairly critical of the proposed MFL. I can criticize the specificity of the number and the sense that this flow will actually meet multiple ecosystem needs. I believe the support to address both of these criticisms is present in the document, but this support must be sharpened.

### 2002 Review

I find that the hydrologic analyses are much improved over the 2001 Draft. The 2002 Draft adequately defines the hydrologic setting, and then makes a good argument for a focus on hydrologic conditions that can be controlled. Although the hydrologic models are not 3-dimensional, the models are used well, calibrated effectively, and shown to provide reasonable estimates with sensitivity analyses. I feel that District staff has effectively addressed major hydrologic modeling issues identified in the 2001 Draft.

In addition to improved hydrologic modeling, the 2002 Draft provides a much improved analysis of historical hydrology, using that historical analysis to support duration and frequency assessments, which improve ecosystem analyses and more fully support the proposed MFL.

## 3. Completeness of the literature review

This reviewer has already made several statements about the literature support.

### 2002 Review

As noted above, I find a good balance between detail in appendices, and literature cited in the appendices, and the selection of literature used to support the summary document.

4. Statistical analysis and interpretation of historical flow and salinity data.

This reviewer is not sure that a statistical analysis was performed on the flow and salinity data. The document noted that half hourly data on salinity was modified to a daily average and flow was only really addressed in relation to a single input. Further, the major "statistical" analysis was the development of a regression model, which produced results that were verified by comparison to a simulation model that was viewed as limited in the report. Again, I will not criticize the approach because I understand that this approach is about the best that could be done as this report was assembled. That is not to say that the most effective use of available data was made. This reviewer will be very interested in a better description of the data resources represented in Appendix D, in

particular the methods of estimating flow and the actual utilization of salinity data. What is very important is the better support of the duration criterion from this data.

### 2002 Review

Another member of the review panel specifically addressed statistical analysis and interpretation issues. I find that the Ds/Db index significantly improves the analysis process. My sense is that the District staff have abandoned the approach criticized last year, substituting improved modeling, improved hydrologic analyses, and an improved method for identifying salinity relationships that include a duration factor in the index.

5. Methods used to estimate the movement and location of the freshwater-saltwater interface under different flow conditions.

The document itself provides a review of this approach, focusing on the hydrodynamic model and listing limits to the model and the potentials for model improvement. Freshwater/saltwater interactions have been extensively studied. The report establishes 2 ppt as a critical threshold, yet acknowledges a limited understanding of the dynamics of lateral movement of saline waters. The three dimensionality of this problem is critical. The report could be strengthened by development of a simple conceptual model of the freshwater-saltwater interface.

### 2002 Review

Although I did not find an explicit description of a simple conceptual model, the 2002 Draft has more effectively addressed long term issues, and with the SAVELOX model, provided a method of effectively connecting hydrodynamics and ecosystem value. The report has done a much better job of use of a 2 ppt threshold, and provided useful alternatives that support comparison of alternatives. It is in this area that I think the District staff has made the biggest step in integrating assessment and analyses to support the MFL. Although I could suggest additional data collection or analyses to better support models, the inclusion of an adaptive management element, which accepts uncertainty in data, models, and decisions suggests that District staff fully recognize limitations, and through research planning, will improve modeling, analysis, and assessment tools as monitoring results are obtained.

6. Methods used to characterize the vegetation community composition and distribution.

# 2002 Review

A major weakness of the 2001 Draft was the over dependence on Bald Cypress analysis in the vegetation assessment. The 2002 Draft has addressed that weakness, and strengthened the vegetation analysis with better analysis of historical aerial photography, additional assessments at critical locations, and an improved VEC analysis approach.

As in any ecological study, data may not be sufficient to fully support all management or decision requirements. I feel the 2002 Draft has sufficiently strengthened the vegetation community analysis to fully support the MFL recommendation.

7. Linkage or correlation of flow and/or salinity data to impact to biological communities (has a scientific linkage been clearly established?).

Comments related to this technical question could be extensive, and will likely be the focus of considerable discussion during the site visit. I have already made comments concerning single parameter emphasis, and the expansion of discussions that might occur as VEC concepts are extended to better portray community/ecosystem relationships. I do not believe that sufficient technical support has been provided in this argument.

### 2002 Review

The approach used to link flow, salinity, and VEC effect is much more sophisticated in the 2002 Draft report. With re-characterization of river miles, and better correlation of past studies, and improved VEC analysis the 2002 Draft does a good job of relating salinity and vegetation impact. The addition of soil sampling, although raising questions about suitability of salinity or Cl measurements, does add a further dimension to this analysis – improving our general understanding of processes and mechanisms operational in the Loxahatchee River. In summary, I feel the correlation of flow and salinity, particularly the incorporation of duration and frequency elements does a much better job of creating the scientific linkage needed for MFL establishment. Again, where scientific linkages are weak, the adaptive management/future monitoring efforts should add needed information to improve MFLs in the future.

8. Use and interpretation of the results of a two-dimensional hydrodynamic-salinity model.

I have responded in #5 above, noting that the document provides a review of model limitations and application. It is noted that there are anticipated modifications that should improve model predictions. Further use of the model should be a focus of upcoming discussions.

### 2002 Review

I find that comments made above address the use and interpretation of models. I find that the 2002 Draft makes much better use of modeling, particularly the integration of modeling and additional assessments to strengthen confidence in the overall process.

9. Use of historical hydrological and/or ecological data and findings to determine a minimum flow criteria for the river.

The document has made excellent use of historical vegetation analysis. A possible improvement would be a listing and brief analysis of the historical trends in other ecological data such as fisheries, bird counts, etc.

With an emphasis on in-channel hydrology, the report is particularly weak in defining freshwater inputs, other than from the Lainhart Dam. A particular point of discussion should be the possible addition of runoff modeling for critical watershed components to better predict tributary inflow.

### 2002 Review

I find that the 2002 Draft makes much better use of historical hydrological and ecological data. The improved approach to long term salinity simulations, the community approach to VEC is a sufficiently strong argument that fisheries and macroinvertebrate data are sufficient to support vegetation analyses.

10. Methods or approaches used to define specific "duration" criteria.

As noted above, in addition to duration, it will be critical to define frequency.

The arguments supporting a duration are admittedly weak. This reviewer wonders if better support for duration could be found in existing data. For example the continuous monitoring study produced salinity data at 30 minute time intervals for approximately 30 days at a deployment. This data may be useful in better defining salinity parameters that would be useful in duration criteria development. It should be recognized that duration issues are fundamentally biological and the arguments associated with Cyprus effects were particularly weak/unsupported by research. The primary method of improvement of the duration criteria will be the development of better biological response data.

### 2002 Review

I have already commented on the improvements in duration and frequency analysis in the 2002 Draft. I feel that the analyses do now support the inclusion of a duration in the technical criteria.